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(54) Title of Invention: An Inspection Device for Printed Matter

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SPECIFICATION

1. TITLE OF THE INVENTION

An Inspection Device for Printed Matter

2. CLAIM

An inspection device for printed matter, wherein printed matter with the same pattern printed repeatedly at right angles on the same sheet of paper is conveyed in a specific direction of conveyance and the printed quality of the patterns is determined by an automatic scanning-type photoelectric conversion detection means, and wherein the inspection device for printed matter is equipped with a standard pattern memory means to house successively the digital pattern signals (A) obtained successively from outputted photoelectric conversion detection signals corresponding to a pattern, and to read and output the pre-recorded digital pattern signals (B) corresponding to the pattern prior to the pattern, and a comparison means to compare digital pattern signals (A) to digital pattern signals (B) and determine the printing quality of the pattern.

3. DETAILED DESCRIPTION OF THE INVENTION

(Industrial Field of Application)

The present invention pertains to an inspection device for printed matter, and more specifically to an inspection device for printed matter used to inspect printed matter in which the same pattern is printed repeatedly at right angles on the same sheet of paper. The inspection device is used in particular to detect stains on the printed surface of certificates or stamps printed repeatedly at right angles on the same sheet of paper.

(Prior Art)

In the various testing devices for printed matter currently in use, a plurality of detectors is arranged along the conveyance route of printed matter in which the same pattern is printed repeatedly on the same sheet. These detectors scan the same portion of adjacent patterns, and the difference between detection signals obtained from the detectors is used to determine the quality of the printed matter. An example of one of these testing devices was disclosed in Japanese Patent Application No. 49-108553.

(Problem Solved by the Invention)

These inspection devices for printed matter use a plurality of detectors to compare the same scanned portion from adjacent identical patterns. In order to maintain detection precision, the beam of light received by the plurality of detectors has to have a one-to-one correspondence from the same portion of adjacent patterns. As a result, setting the plurality of detectors requires complicated adjustments and mechanisms. Any difference in sensitivity of the light receiving elements for photoelectric detection due to the optics and illumination of the detectors can cause an error signal in the photoelectric conversion detection signals. If the error signals exceed a certain level, the quality of the printed matter can be misjudged.

(Means of Solving the Problem)

The present invention is an inspection device for printed matter, in which printed matter with the same pattern printed repeatedly at right angles on the same sheet of paper is conveyed in a specific direction of conveyance and the printed quality of the patterns is determined by an automatic scanning-type photoelectric conversion detection means, and in which the inspection device for printed matter is equipped with a standard pattern memory means to house successively the digital pattern signals (A)

obtained successively from outputted photoelectric conversion detection signals corresponding to a pattern, and to read and output the pre-recorded digital pattern signals (B) corresponding to the pattern prior to the pattern, and a comparison means to compare digital pattern signals (A) to digital pattern signals (B) and determine the printing quality of the pattern.

(Preferred Embodiment)

The following is an explanation of a preferred embodiment of the present invention with reference to the drawing.

FIG 1 is a block diagram showing the essential components in a preferred embodiment of the present invention. The preferred embodiment in FIG 1 is equipped with a light projector 1 corresponding to the printed matter 2 conveyed in conveyance direction 101, an automatic scanning-style photoelectric detector 3, an analog-to-digital converter 4, a standard pattern 5, a photoelectric detector drive control circuit 6, a rotary encoder 7, a timing control circuit 8, a memory address control circuit 9, and a comparison circuit 10.

In FIG 1, the printed matter 2 is conveyed at the desired speed in the conveyance direction 101. Light form the light projector 1 is reflected off the printed matter, and the reflected light 102 is received by the automatic scanning-style photoelectric detector 3. The light is converted to electric signals, and sent to the analog-to-digital converter 4 as photoelectric conversion detection signals. The automatic scanning-style photoelectric detector 3 in the preferred embodiment is a charge coupled device (CCD) controlled by drive pulse signals ϕ_R and scanning switching signals ϕ_T from the photoelectric detector drive control circuit 6. The light beams received by the automatic scanning-style photoelectric detector 3 are scanned electrically. The light beams are scanned perpendicular to conveyance direction 101 of the printed matter 2. The photoelectrically converted detection signals corresponding to the pattern on the printed matter 2 are taken up successively along the direction of conveyance 101.

The photoelectric conversion detection signals inputted to the analog-to-digital converter 4 are converted from analog to digital signals using the timing signals from the timing control circuit 8. These signals are then sent to the standard pattern memory 5 and comparison circuit 10 as digital pattern signals corresponding to the pattern on the printed matter 2. The standard pattern memory 5 is controlled by address specifying signals from the memory address control circuit 9. The digital pattern signals inputted from the analog-to-digital converter 4 are stored at specific addresses for each pattern. The digital pattern signals corresponding to the pattern stored before the current one are then outputted to the comparison circuit 10. Using specific timing signals from the timing control circuit 8, the comparison circuit 10 compares the digital pattern signals sent directly from the analog-to-digital converter 4 with the digital pattern signals corresponding to the pattern stored before the current one in the standard pattern memory 5, and outputs a quality signal E for the digital pattern signals inputted directly from the analog-to-digital converter 4.

The standard pattern memory 5 and the comparison circuit 10 operate in tandem. The conveyor positions of the various patterns on the printed matter 2 are detected by a rotary encoder 7 that drives a rotating mechanism used to convey the printed matter 2. The conveyor position signals corresponding to the patterns are inputted to the memory address control circuit 9 via the timing control circuit 8. These signals are controlled by specific timing signals from the timing control circuit 8. The drive pulse signals generated by the drive control circuit 6 and sent to the automatic scanning-style photoelectric detector 3 are inputted to the memory address control circuit 9. The memory address control circuit 9 sets the memory address for the scanning positions of the patterns on the printed matter 2 based on the conveyor position signals and drive pulse signals. Address designating signals are then generated and sent to the standard pattern memory 5. When there is a change in the conveyance speed of the printed matter 2, the transfer clock blanking period of the automatic scanning-style photoelectric detector 3 is changed by a signal from the rotary encoder 7 in order to prevent a disruption in the relationship between the scanning position and the position of the patterns on the printed matter 2. The timing control by the timing control

circuit 8 is also reset so that the digital values corresponding to the same portions of the patterns are inputted to the same memory address.

The patterns arranged on the printed matter 2 along the direction of conveyance 101 are detected successively as photoelectric conversion detection signals by the operation of the various components. These photoelectric conversion detection signals are compared to the detection signals for the adjacent pattern, and the difference is used to determine the quality of the printed matter.

(Effect of the Invention)

The present invention uses a single automatic scanning-style photoelectric detector to scan the same pattern printed repeatedly at right angles on the same sheet of paper. As a result, a plurality of detectors does not have to be adjusted using complicated methods and mechanisms. There is also no difference in the sensitivity of the light receiving elements for photoelectric detection due to the optics and illumination of a plurality of detectors. As a result, errors do not occur in the photoelectric conversion detection signals. Because the transfer clock blanking period of the automatic scanning-style photoelectric detector is automatically adjusted, there is no need to adjust the scanning of the same portion of the same pattern.

4. BRIEF EXPLANATION OF THE DRAWINGS

FIG 1 is a block diagram of a preferred embodiment of the present invention.

1 ... ... light projector, 2 ... ... printed matter, 3 ... ... automatic scanning-style photoelectric detector, 4 ... ... analog-to-digital converter, 5 ... ... standard pattern, 6 ... ... photoelectric detector drive control circuit, 7 ... ... rotary encoder, 8 ... ... timing control circuit, 9 ... ... memory address control circuit, 10 ... ... comparison circuit

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FIG 1

1 ... ... light projector, 2 ... ... printed matter, 3 ... ... automatic scanning-style photoelectric detector, 4 ... ... analog-to-digital converter, 5 ... ... standard pattern, 6 ... ... photoelectric detector drive control circuit, 7 ... ... rotary encoder, 8 ... ... timing control circuit, 9 ... ... memory address control circuit, 10 ... ... comparison circuit